Office of the Chief Engineer
Office of the Chief Financial Officer

# New Initiatives in Program and Project Management

## Project Management Challenge 2005

March 22, 2005

**Joe Hamaker**
Director, NASA Headquarters Cost Analysis Division

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NASA Deputy Chief Engineer
for Program and Project Management Policy

# Drivers for Change


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## ✦ Transformation of NASA

- CAIB / Return to Flight
- Renewed Commitment to Excellence (Diaz Report)
- Report of the President's Commission (Aldridge Report)
- Vision for Exploration
- Clarity Team Report

## ✦ External and Internal Initiatives

- OMB and GAO "Guidance"
- Governmental collaborations (e.g., eGov, DAU, DoD / DoE)
- Culture Change / OneNASA
- Strategic Alignment
- Financial Management Practices (e.g., IFMP, Full-Cost Accounting)

# Summary of Major Changes in 7120.5C


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- Inclusion of all NASA Investments
- Product Line Management
- Project Categorization
- Return to “Lifecycle Phases” terminology
- Implementation of Independent Technical Authority
- Inclusion of recommendations from CAIB /Diaz reports
- Cost estimating, CADRe, CCRM, Full Cost, EVM
- Living requirements document - change process defined
- Requirements “tailorable” through deviations and waivers
- Compliance Matrix

# NASA Program and Project Management Processes and Requirements Document NPR 7120.5C


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# Eleven Diaz Actions Incorporated in 7120.5C


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| Action(s) | Description |
|---|---|
| 1,2,21 (Partially Closed) | (1) *Review/develop current policy or guidance that assures critical event data is collected, observed and analyzed (2) Develop a standard for comprehensive program risk management and observable data collection for all phases of program development, test, operation to be used for program management, improvement, anomaly/disaster reconstruction (21) Identify methods used by other test organizations to perform remote system testing and anomaly resolution* |
| 6 | *"Develop a standard for program development strategy based on the program focus of R&D versus operational system or infrastructure that focuses on the comprehensive assessment of program management, technical, and operational risks; all of these factors must be incorporated into the development of an integrated program schedule."* |
| 9 (Partially Closed) | *"Develop plans for implementing an Independent Technical Engineering Authority (ITEA) of the scope envisioned by the CAIB"* |
| 24,28,35 | *(24) Identify clear chains of command in a program including responsibility, accountability, and authority for issue communications. (28) Develop a clear process for management chain of command and communications within a program and among government organizations and program management/contractor interfaces for anomaly request and resolution. (35) Review communications policies and reports. The review will focus on the requirements for formal reporting during normal and emergency/crisis times. For formal reporting during normal operating tempo, the frequency of the reports shall be determined, and who produces/reviews, and approves these reports.* |
| 30 | *"Expand upon the process for independent program reviews (Independent Assessments, Independent Implementation Reviews, and Non-Advocate Reviews) that require re-review when any interim major milestone slips to determine the impact on mission completion schedule and cost risk"* |
| 31 | *"Perform a comprehensive assessment of major program interdependencies."* |
| 33 | *"Perform an assessment of best industry practices for R&D, completion, and operational programs to assess the management of schedule and cost risk through the development of management reserves."* |

# Chapter 1:
# Overview of the NASA Environment


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- ***Budget Framework aligned with the Strategic Framework***
- ***Program and Project Definitions***
- ***Product Lines with appropriate lifecycles:***
  - **Management Requirements Developed to Support the Different Types of NASA Investments**
    - **Basic and Applied Research Portfolios**
    - **Advanced Technology Development Projects**
    - **Flight Systems and Ground Support Projects**
    - **Institutional Projects**
- ***Categorization:***
  - **Projects are Categorized I, II, or III depending on lifecycle cost and priorities established by the Agency**
- ***Four-Part Management Process***
  - **Formulation**
  - **Approval**
  - **Implementation**
  - **Evaluation**

# Strategic Framework Aligned to Budget Framework

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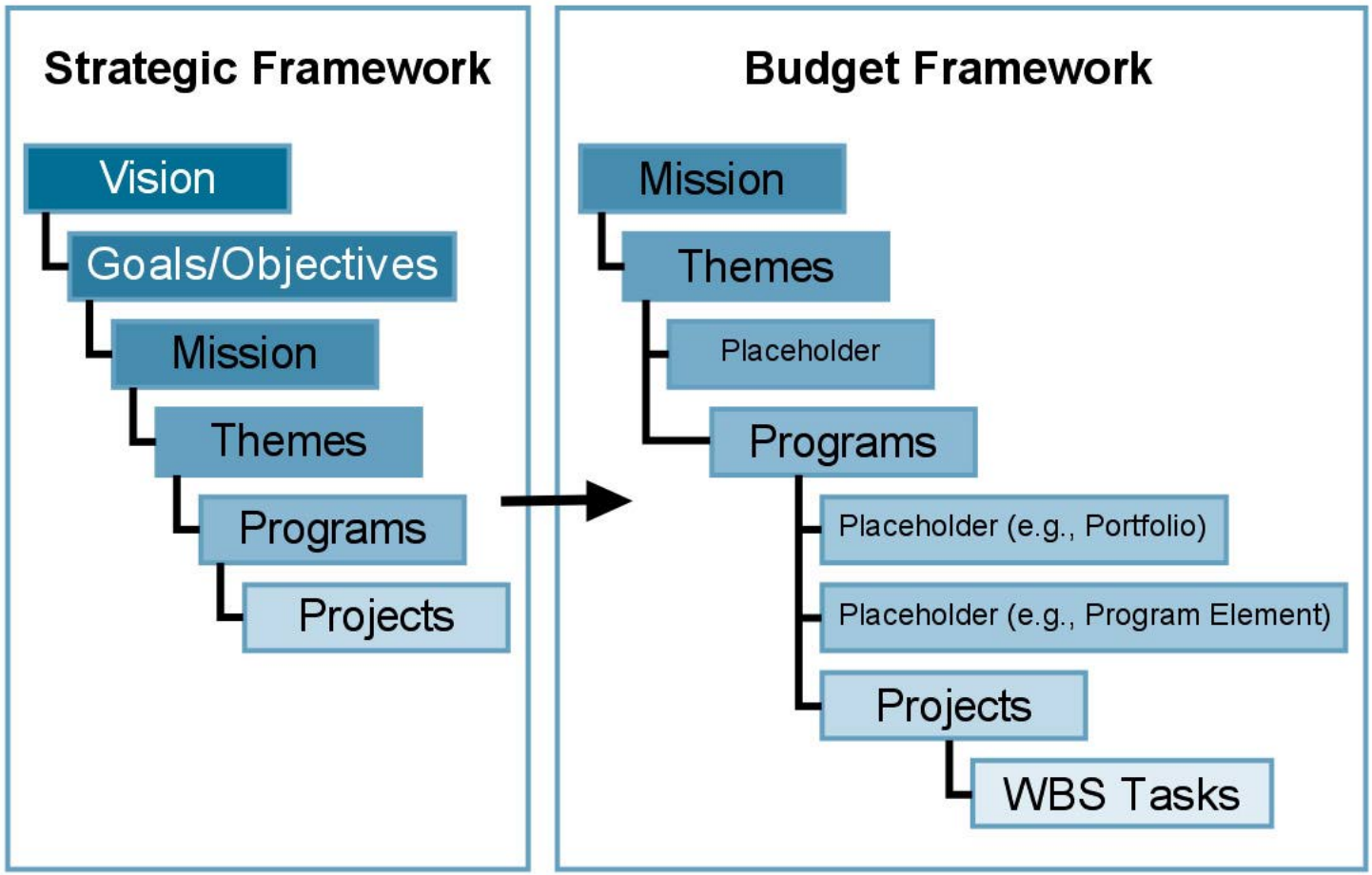
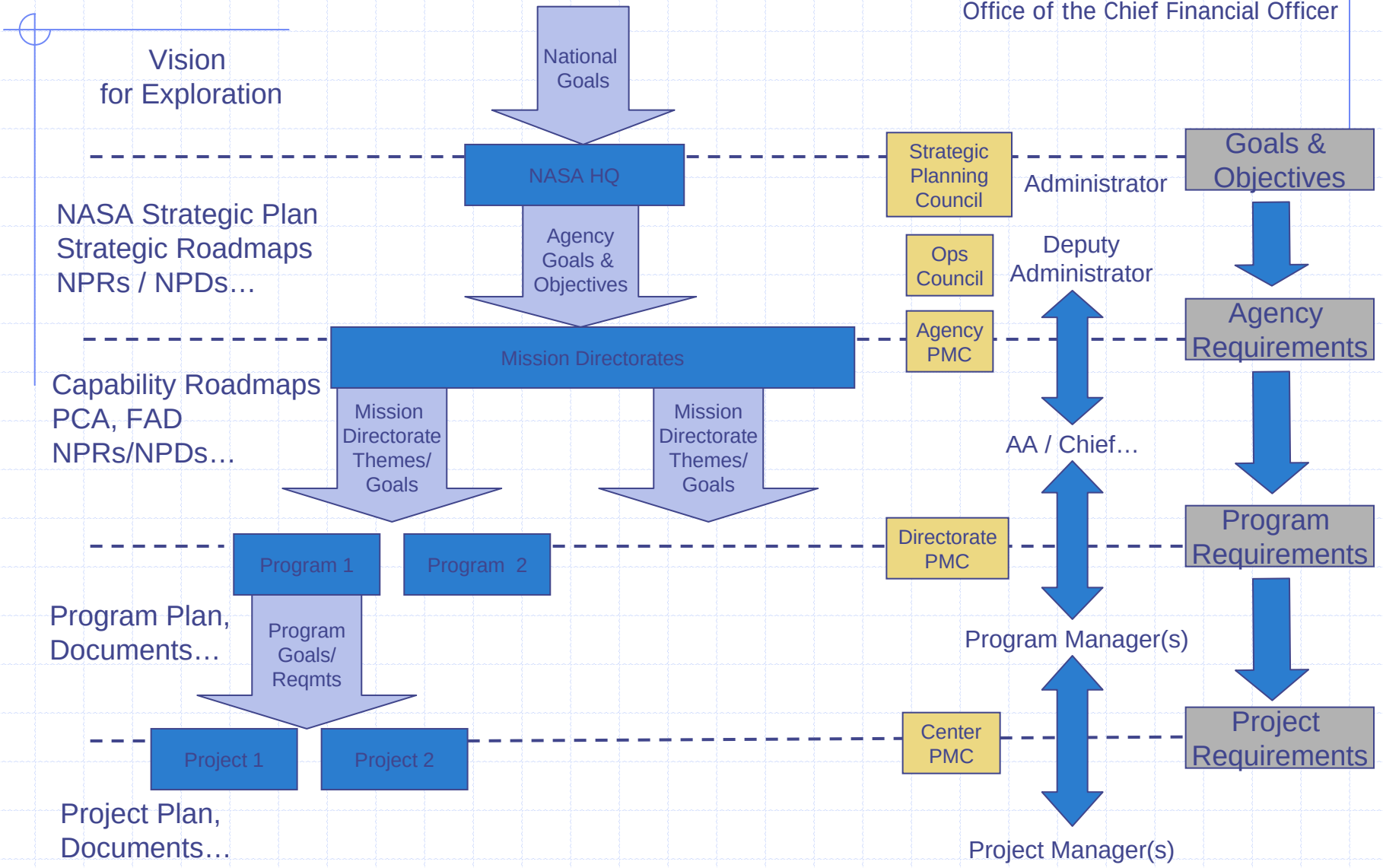


# Requirements Flow and Documentation



# Program and Project Definitions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- **Program:** **A strategic investment by a Mission Directorate or Mission Support Office that has defined goals, objectives, architecture, funding level, and a management structure that supports one or more projects. A Program usually contains several projects or portfolios of investigation.**

- **Project:** **A discrete investment defined in a Program Plan having defined goals, objectives, requirements, lifecycle cost, a beginning and an end. A project yields new products or services that directly address NASA's strategic needs.**

Note: Investment is defined as the Full Cost required to achieve the Agency, Mission Directorate, or Mission Support Office goals.

# Product Line Management

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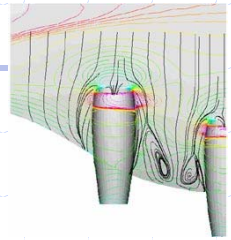
- **Basic and Applied Research Portfolios**
  - Usually level of effort through award of grants



- **Advanced Technology Development**
  - Advancement of TRLs, usually spiral development

- **Flight Systems and Ground Support**
  - Standard waterfall development and evolutionary acquisition
  - Operations typically level of effort with significant ramps

- **Institutional Projects**
  - Combination of waterfall and level of effort developments

# Categorization of Projects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| Priority | Life Cycle Cost | | |
|---|---|---|---|
| | LCC < $100M | $100M ≤ LCC < $500M | LCC ≥ $500M |
| High | Category II | Category I | Category I |
| Moderate | Category III | Category II | Category I |
| Low | Category III | Category III | Category II |

## Priority is a complex variable that can include:

- Importance of the activity (project in-line with the critical path of the Strategic and Capability Roadmaps)
- Complexity of the activity (international participation, joint effort with other government agencies, etc.)
- Uncertainty surrounding the application of new and untested technologies
- Presence of nuclear materials on board
- Systems being developed for human spaceflight
- Spacecraft development classification (NPR 8705.4, Risk Classification for NASA Payloads)

# Project Categorization Determines Governance


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| Project Category (From Table 1-1) | Governing PMC | Review Team Lead |
|---|---|---|
| Category I | Agency PMC | IPAO |
| Category II | Mission Directorate PMC (or MSOD) | IPAO and/or SMO |
| Category III | Center PMC* | SMO** |

* or Mission Directorate SMC for basic and applied research
** or external scientific exports for basic and applied research

**Management Oversight Aligned with the Magnitude of the Investment**

# Chapter 2:
# Program Management Requirements


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- Preparation of a Program Plan using template provided in document
- All Programs are governed by the Agency PMC
- All Programs must have a signed Program Commitment Agreement (PCA)
- Two-phase process: Formulation and Implementation
- Program Implementation Reviews (PIR) will be conducted on all programs in implementation biennially (every three years on Basic and Applied Research Programs)
- Reviews conducted by Independent Program Assessment Office (IPAO) through Terms of Reference with the Mission Directorate or Mission Support Office

# Chapter 3:
# Common Project Management Requirements


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- Emphasis on planning and the preparation of a Project Plan using template provided in document
- Project Control and Cost Estimating (EVM, CADRe, Full Cost)
- Independent Technical Authority
- Risk Management
- Categorization determines governing PMC
- Breaches established against the project baseline
- Reviews conducted by independent assessment organization (determined by categorization) through Terms of Reference with the Mission Directorate or Mission Support Office

# Chapter 4:
# Basic and Applied Research Portfolios

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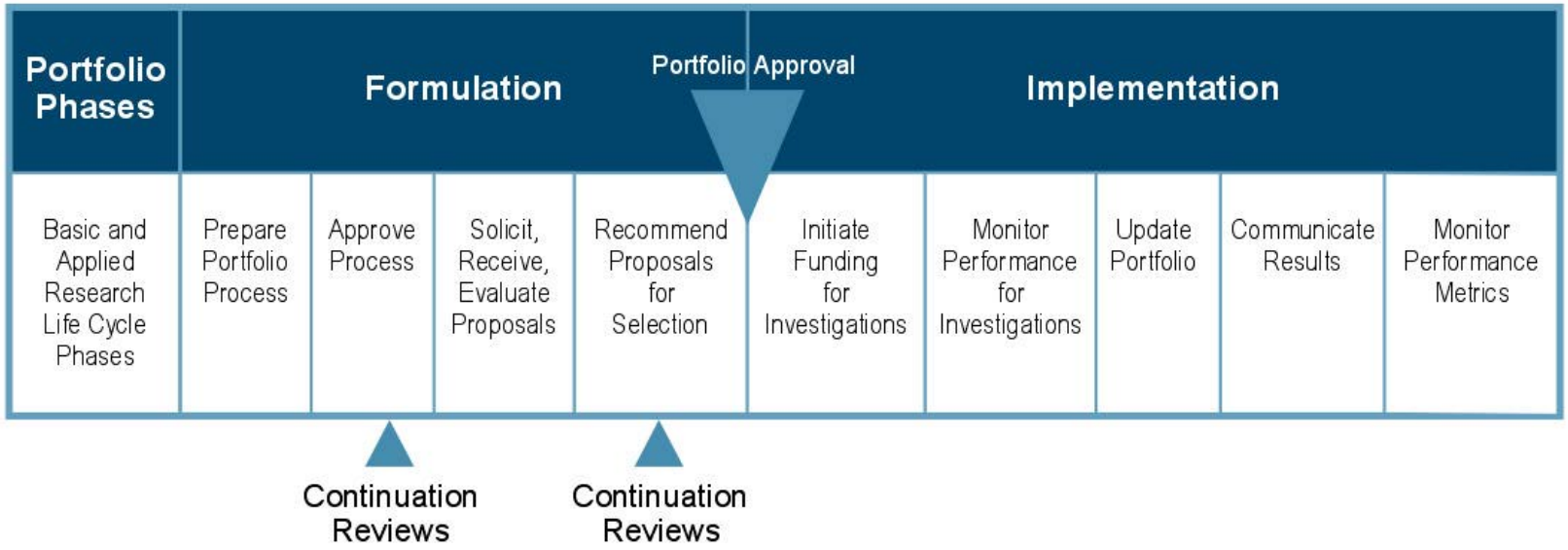
- Portfolio Process Planning
- Proposal solicitation, evaluation, and selection
- MDAA or MSOD through the selection official approves selection of proposals
- Initiates funding and updates portfolio
- Peer review of progress reports and annual evaluations



# Chapter 5:
# Advanced Technology Development Projects

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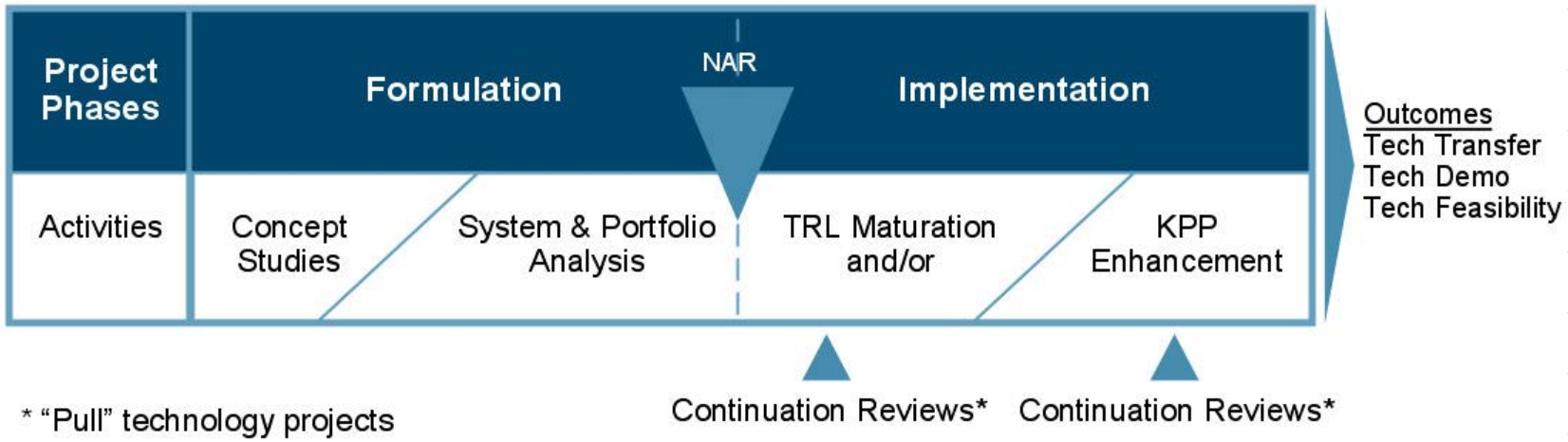
- Perform portfolio analyses, identify Key Performance Parameters (KPPs),
- Prepare Project Plan
- Approval secured as in the common project chapter
- Mature technology and report progress against KPPs and TRLs
- Typically at the Mission Directorate or Center due to the categorization thresholds



# Chapter 6:
# Flight Systems and Ground Support Projects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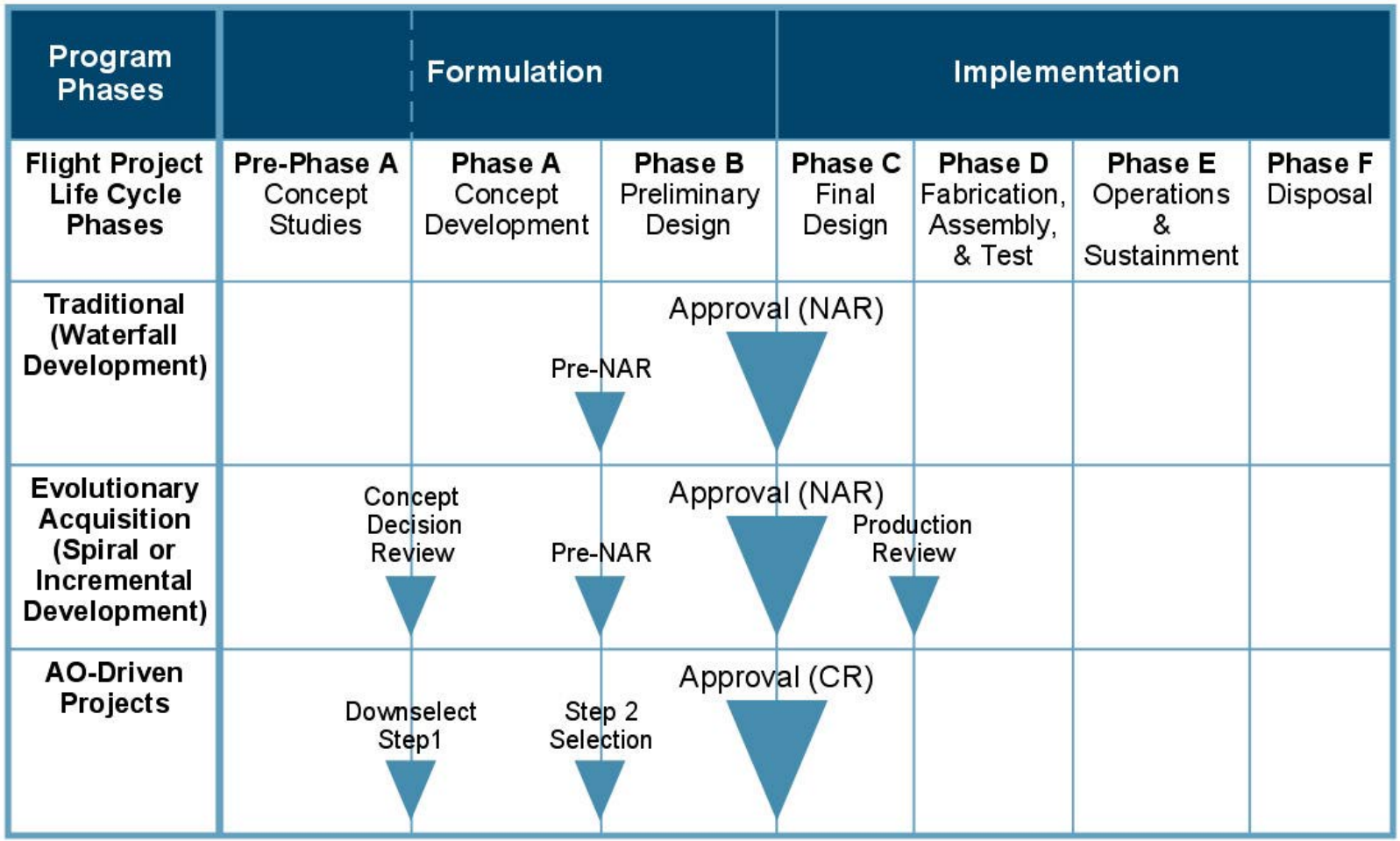
- Cost Analysis Data Requirement (CADRe), Continuous Cost Risk Management (CCRM), Cost Estimation, Common Core Level II WBS (per appendix), Integrated Schedules
- Special consideration to projects with long duration operations and sustainment
- Evolutionary acquisition incorporated
- Approval secured as in the common project chapter
- Refined operation success criteria for projects with long duration operations
- At a minimum, Pre-NAR and NAR per categorization scheme

# Chapter 6 cont.:
# Flight Systems and Ground Support Projects





# Chapter 7:
# Institutional Projects

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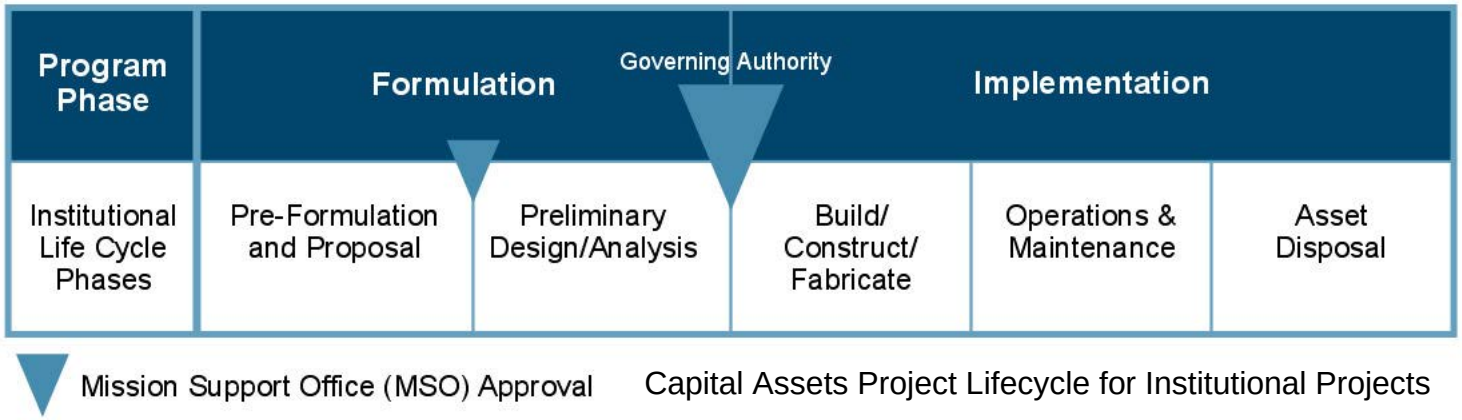
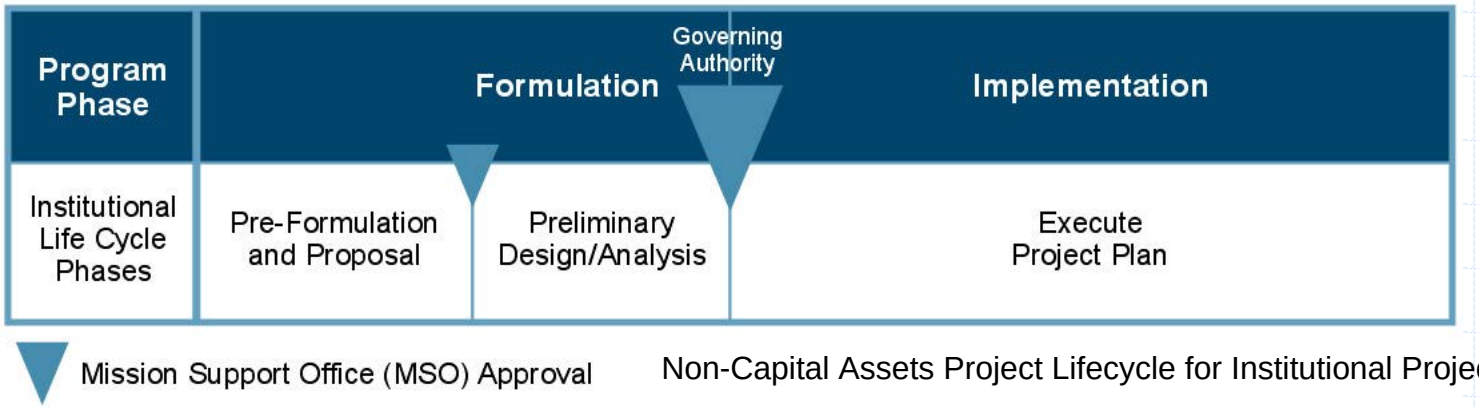
- Real property (CoF, Environmental Compliance and Restoration), Information Technology, Other Functional Initiatives (Education, Mission Support Office investments)
- Requirements and approval process designed to accommodate various project types




Capital Assets Project Lifecycle for Institutional Projects




Non-Capital Assets Project Lifecycle for Institutional Projects

# Appendices:




- Templates
  - Formulation Authorization Document (FAD)
  - Program Commitment Agreement (PCA)
  - Program Plan
  - Project Plan
  - Cost Analysis Data Requirement (CADRe)
  - Compliance Matrix
- Reviews
- WBS
- References
- Definitions
- Acronyms
- Index
- Deviation / Waiver Form

# Special Thanks to: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# Cost Estimating Initiatives In NPR 7120.5C

**Joe Hamaker**
Director, NASA Headquarters Cost Analysis Division

# 2004 GAO Report on NASA Cost Estimating

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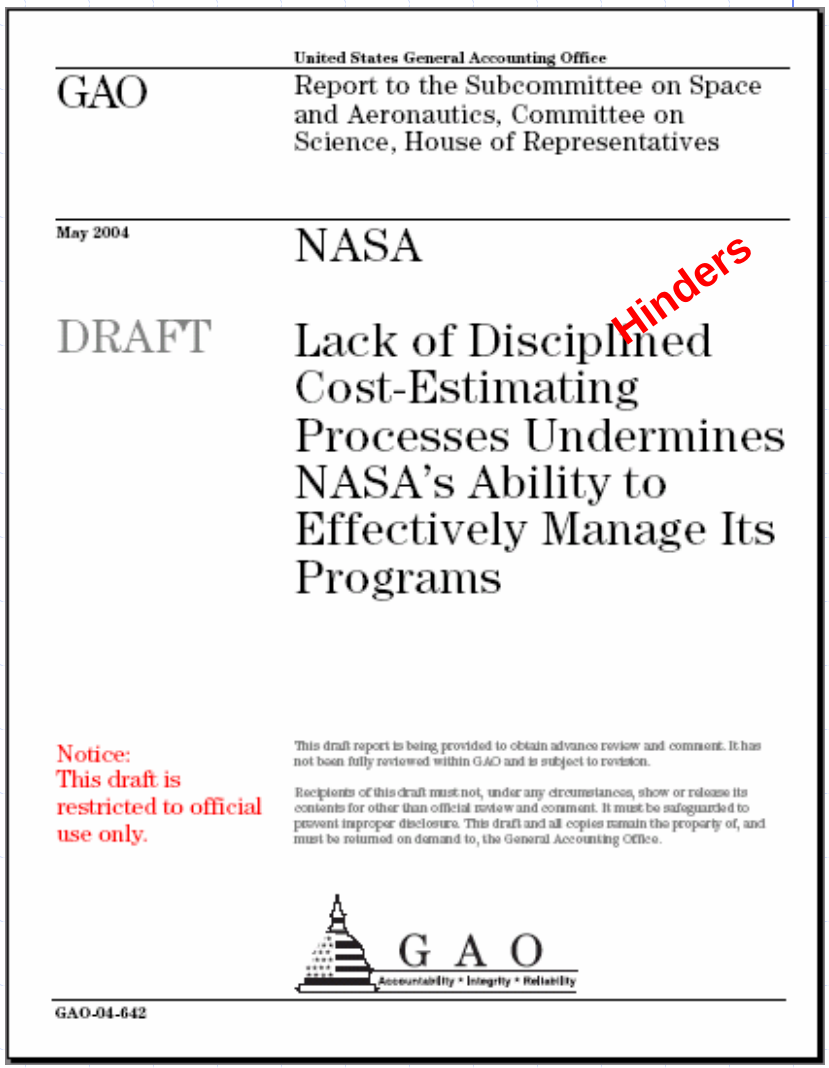
- Scope included 27 projects
  - Median cost growth of 13%
  - (Absolute mean deviation of 26%)
- Recommendations
  - Develop an integrated plan including
    - Guidance for rebaselining
    - Enforced use of Earned Value Management
    - Staff and support for cost-estimating and EVM
  - Establish a standard framework for Life Cycle Cost Estimates
    - Based on a full Life Cycle Cost
    - Using a WBS encompassing both in-house and contractor efforts
    - Using CARDs
    - With Independent Cost Estimates at each milestone
    - Using cost risk assessments
  - Prohibit projects from proceeding through the review and approval process without above



United States General Accounting Office

GAO

Report to the Subcommittee on Space and Aeronautics, Committee on Science, House of Representatives

May 2004

NASA

DRAFT

Hinders

Lack of Disciplined Cost-Estimating Processes Undermines NASA's Ability to Effectively Manage Its Programs

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GAO-04-642

# 2004 Aldridge Commission Recommendations On NASA Cost Estimating

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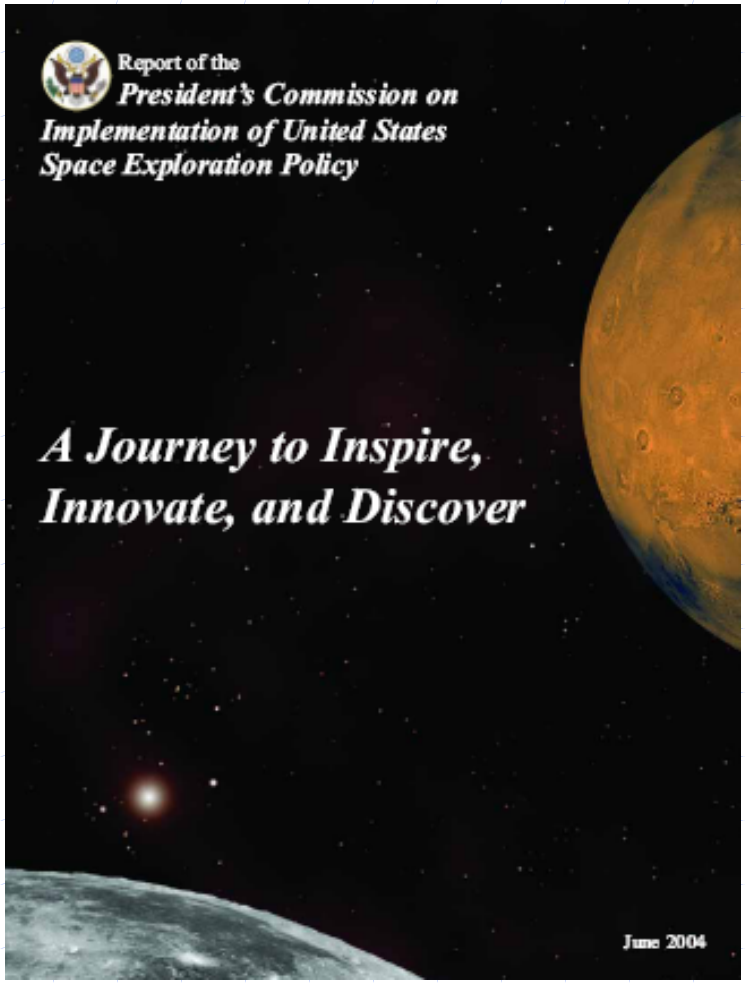
- Recommended an independent cost analysis organization similar to DoD CAIGs (Cost Analysis Improvement Group)
  - Independent cost estimating organization
  - Maintains corporate data base of historical project cost information
  - Generally uses parametric cost estimating procedures
  - Recommends final cost position to approving bodies



# NPR 7120.5C

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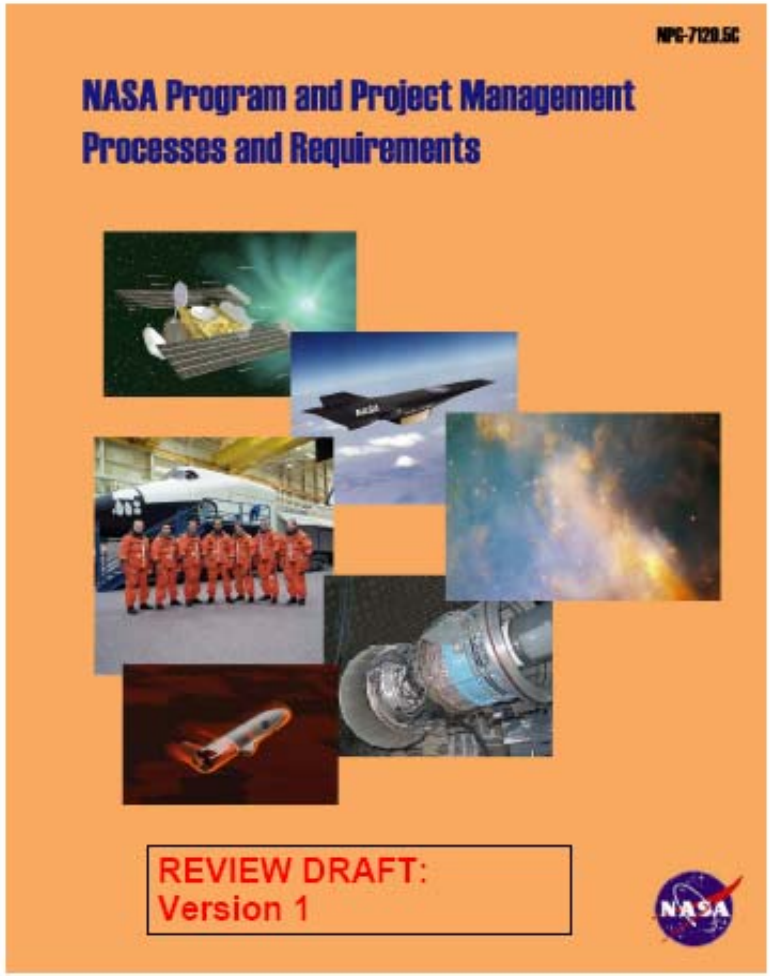
- Initiatives to improve Agency cost estimating are documented in the new NASA Cost Estimating Handbook (www.ceh.nasa.gov)
- Cost initiatives addressed
  - HQ Cost Analysis Division and Independent Program Assessment Office (IPAO) "CAIG-like" capability
  - Use of Continuous Cost Risk Management to improve coordination across cost communities of practice
  - The use of EVM
  - The use of cost risk analysis to quantify uncertainty
  - Commonality in work breakdown structures
  - Better cost documentation using a Cost Analysis Data Requirement (CADRe)
  - A corporate cost data base-the One NASA Cost Engineering (ONCE) database



# 2004 NASA Cost Estimating Handbook

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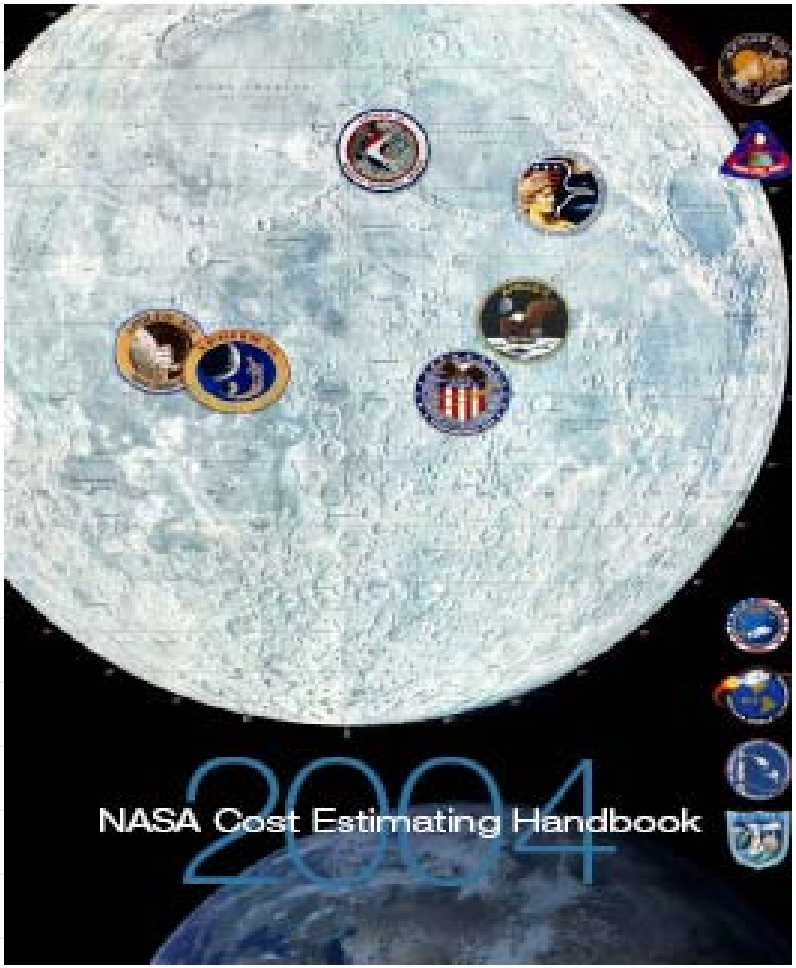
- Completely revised since 2002 Edition
- Purpose and Objectives
  - **To provide a best practices resource**
  - **Tied closely to NPR 7120.5C**
- Scope
  - **Approaches broad cost-estimating topics through general concept discussions and generic processes, techniques, and tool descriptions**
  - **Introduces Continuous Cost Risk Management (CCRM)**
- A living document at www.ceh.nasa.gov



# Continuous Cost-Risk Management

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- A cost management architecture providing:
  - Early identification of medium- and high-risk WBS elements
  - Communication of WBS risk elements to project managers for focused cost management
  - Emphasis on WBS risk elements in cost estimating
  - Post-cost estimate tracking of identified risk WBS element using EVM system
  - Updates, collection and archiving of technical and cost data for cost model improvement

***Use***
Cost-Risk Feedback: Steps 9-12


***Set Up***
Cost-Risk Feedback: Steps 1-5

***Get***
Cost-Risk Feedback: Steps 6-8

***Incorporated in NPG 7120.5C***

# Cost Risk Analysis

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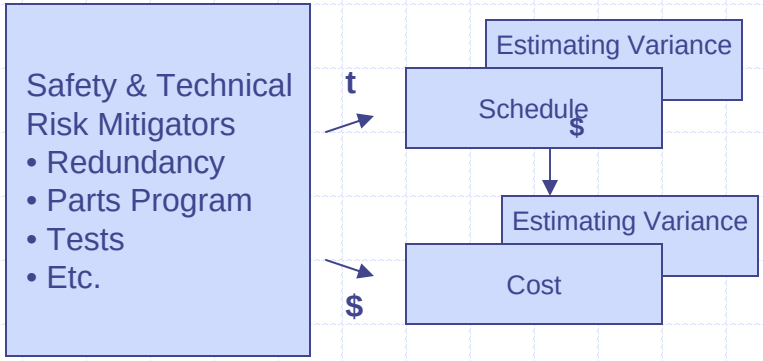
## Risk Areas

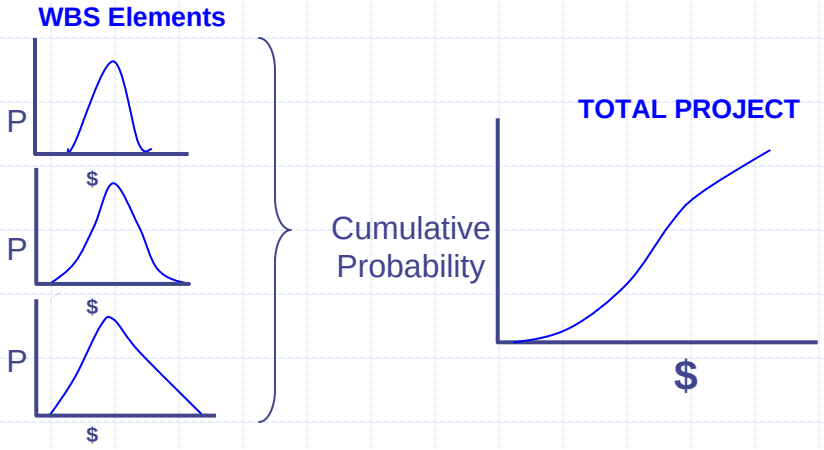
- Safety
- Technical/Performance/ Engineering
- Schedule, programmatic risk
- Cost estimating uncertainty

From CRM*

*CRM=Continuous Risk Management

## "Dollarizing" Risks




- All cost estimates are really probability distributions
- Cost risk analysis quantifies budget reserves necessary for acceptable level of confidence

# Common Level 2 WBS for Flight Systems and Ground Support Projects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- Good corporate knowledge base management requires some level of WBS standardization
  - Long recognized in DOD with MIL-HDBK-881
  - DoD, NRO, Air Force, with NASA participation, currently updating MIL-HDBK-881 for space systems
- NASA budget and cost community desire common WBS for product lines
- December 8-9, 2004 HQ meeting (with all centers represented) agreed to a common structure to Level 2
  - Cost analysis community trying to agree to level 4 WBS (maps may be required) for CADRe

| 1.0 Project |
| --- |
| 1.1 Program Management |
| 1.2 Systems Engineering |
| 1.3 Safety and Mission Assurance |
| 1.4 Science/Technology |
| 1.5 Payload |
| 1.6 Aircraft/Spacecraft |
| 1.7 Mission Operations |
| 1.8 Launch Vehicle/Services |
| 1.9 Ground Systems Development |
| 1.10 System Integration Assembly & Test |
| 1.11 Education & Public Outreach |

# Cost Analysis Data Requirement (CADRe)


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- CADRe is a Data Requirement on new high dollar value flight projects
  - Configuration control for the cost estimate
  - Documents the project technical and programmatic basis of estimate and the corresponding cost estimate in one document
  - Snapshots taken ≤ 6 times over project life cycle
- DoD has had a similar approach in place for many years
  - CARDs (Cost Analysis Requirement Description)
  - CCDRs (Contractor Cost Data Report)
- Ultimately, CADRe feeds a new corporate cost estimating data base
  - ONCE (One NASA Cost Engineering Data Base)
  - To be managed by the IPAO

| Priority | Life Cycle Cost | | |
|---|---|---|---|
| | LCC<$100M | $100M < LCC < $500M | LCC > $500M |
| High | Category II (CADRe Required) | Category I (CADRe Required) | Category I (CADRe Required) |
| Moderate | Category III | Category II (CADRe Required) | Category I (CADRe Required) |
| Low | Category III | Category III | Category II (CADRe Required) |

# Cost Initiatives Implementation Plan


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- Phase 1 – Conduct Workshops at Centers
  - Communicate NPR 7120.5C policy changes
  - Obtain feedback, revise cost initiatives accordingly
  - February - March 2005
  - Codify in NPR 7120.5C and the CEH
- Phase 2 –Communicate and Facilitate Policy Changes
  - Joint OCFO Cost Analysis Division and Office of Chief Engineer Center road shows
  - Projected dates: May-June 2005
- Phase 3 – Train
  - Detailed CCRM 2 day training seminar at the Centers
  - Projected dates: July - September 2005

# Questions?


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**Cost initiatives will be covered in more detail in a session this afternoon: 4:00-5:00, Room 0105**